

REMARKS

Applicants thank the Examiner for the careful consideration given this application. Applicants respectfully request reconsideration of this application in view of the amendments above and the remarks below.

Status of the Claims

- Claims 1-25 are pending. Claims 1, 16, and 21 and 24 are independent.
- The Office Action objected to claims 13-15 as being dependent upon a rejected base claim, but found them to be allowable if rewritten in independent form include all of the limitations of the base claim and any intervening claims. Applicants appreciate the conclusion that these claims recite patentable subject matter.
- Claims 1, 16, and 21-25 have been amended. By these amendments, no new matter has been entered.

Amendments to The Independent Claims

The presence of the term "lumel" in claim 1, 16, 21 and 23 should be enough, in combination with the other elements of these claims, to distinguish over the references of record. Nonetheless, these claims have been further amended so that the distinctions already implied by the term "lumel" in view of the specification are more plainly apparent. Support for the amendments may be found, among other places, at pages 8-10 of the specification. Claims 22, 24 and 25 have been amended for consistency with their respective amended base claims.

Rejection of Claims 1-12 and 16-20

Claims 1-5, 8-9, 11 and 16-15 under 35 U.S.C. § 103(a) stand rejected as unpatentable over Wolfe ("Teaching Texture Mapping Visually," submitted by applicants) in view of Geng (Publ. No. 2003/0123713) and Arias (Pat. No. 5,966,134); claims 6-7 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Wolfe, Geng and Arias and further in view of Gatti (Publ. No. 2002/0009224); and claim 12 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Wolfe, Geng and Arias and further in view of Wober (Pat. No. 5,748,792). The Applicants respectfully traverse these rejections.

Wolfe merely teaches use of texture mapping in a conventional way to achieve a conventional result, demonstrating visualization techniques for teaching texture mapping in an academic environment. Wolfe fails to disclose or suggest:

receiving information defining a digital object, wherein the digital object comprises a computer-generated three-dimensional surface geometry **to be rendered to produce an appearance of translucent skin material**, and wherein the information is sufficient for defining modeled light reflected from the surface geometry of the digital object in a modeled light environment;

generating, using a simple reflectance model, a two-dimensional light intensity matrix representing diffuse reflection from a modeled color-neutral surface of the digital object in the modeled light environment exclusive of sub-surface scattering effects, each matrix entry being a lumel representing a modeled light intensity correlated to a mapped unique surface element of the digital object;

blurring the light intensity matrix, thereby producing a blurred matrix; and

rendering the digital object, using matrix entries from the blurred matrix to determine pixel intensity values for the digital object combined with a color map representing specular surface reflection from a modeled non-neutral surface of the digital object in the modeled light environment, to produce an appearance simulating subsurface scattering in the translucent skin material

as defined by claim 1. Wolfe is unconcerned with producing “an appearance of translucent skin material,” and, among other things, fails to disclose or suggest any use of the claimed “light intensity matrix” or of any “lumel.” Instead, Wolfe merely discloses a two-dimensional texture map, which reads on a “color map representing specular surface reflection from a modeled non-neutral surface of the digital object.” Wolfe also fails to disclose blurring the light intensity matrix or rendering the digital object “using matrix entries from the blurred matrix to determine pixel intensity values for the digital object combined with a color map representing specular surface reflection from a modeled non-neutral surface of the digital object in the modeled light environment, to produce an appearance simulating subsurface scattering in the translucent skin material.”

Geng and Arias do not make up for these deficiencies. Both Geng and Arias likewise fail to disclose any method for producing “an appearance of translucent skin material” in a rendered digital object. Geng is cited as disclosing “information defining a digital object . . . sufficient for defining modeled light reflected from the surface geometry

of the digital object in a modeled light environment.” Office Action, p. 4. Regardless of the error or correctness of that assertion, it is clear that Geng fails to disclose the claimed light intensity matrix “representing diffuse reflection from a modeled color-neutral surface of the digital object in the modeled light environment exclusive of sub-surface scattering effects, each matrix entry being a lumel.” It is acknowledged that Geng fails to disclose or suggest any blurring operation. Geng also fails to disclose or suggest “using matrix entries from the blurred matrix to determine pixel intensity values for the digital object combined with a color map representing specular surface reflection from a modeled non-neutral surface of the digital object in the modeled light environment, to produce an appearance emulating subsurface scattering in the translucent skin material.”

For its part, Arias is cited as disclosing blurring of a light intensity matrix. This is incorrect. Arias fails to disclose any blurring or any other operation on, or any use of, a light intensity matrix “representing diffuse reflection from a modeled color-neutral surface of the digital object in the modeled light environment exclusive of sub-surface scattering effects, each matrix entry being a lumel.” Arias is instead concerned with computer rendering an animation cel “that simulates a traditional hand-drawn cartoon cel.” Abstract. As such, Arias exclusively discloses manipulation of two-dimensional images, i.e., animation frames, to make them appear more like hand-drawn images. Therefore, blurring or other operations on two-dimensional images to make them appear more like flat, hand-drawn images has no relevancy under 35 U.S.C. § 103(a) to the claimed blurring of a light intensity matrix in a rendering process for a three-dimensional digital object. Both the purpose and effect of the blurring operation in Arias is completely different from and unrelated to what is claimed. Arias fails to disclose the claimed purpose and process of “rendering the digital object, using matrix entries from the blurred matrix to determine pixel intensity values for the digital object combined with a color map representing specular surface reflection from a modeled non-neutral surface of the digital object in the modeled light environment, to produce an appearance simulating subsurface scattering in the translucent skin material.” Likewise, Arias fails to disclose “blurring the light intensity matrix, thereby producing a blurred matrix.” It need hardly be said that a two-dimensional animation frame cannot be reasonably read on the claimed light intensity matrix “representing diffuse reflection from a modeled

color-neutral surface of the digital object in the modeled light environment exclusive of sub-surface scattering effects.” An animation frame as disclosed by Arias does not “represent diffuse reflection” nor is it generated by a “simple reflectance model” from a “from a modeled color-neutral surface of the digital object in the modeled light environment.” These deficiencies apply whether or not the animation frame is rendered from a 3D model, because Arias fails to specifically disclose modeling diffuse reflection from a modeled color-neutral surface to generate a light intensity matrix, nor is there any other evidence to show that the claimed light intensity matrix was known in the art for any purpose related to simulating subsurface scattering in translucent materials.

Therefore, the combination of Wolfe, Geng and Arias fails to disclose every element of independent claim 1, and cannot be combined to provide the claimed method. Therefore, these references could not have made claim 1 obvious, and it is allowable over them.

Likewise, with respect to claim 16, Wolfe, Geng and Arias, separately, or in combination, fail to disclose or suggest:

system comprising a memory holding a two-dimensional light intensity matrix representing diffuse reflection from a modeled color-neutral surface of the digital object in a modeled light environment without subsurface scattering effects, each matrix entry being a lumel representing a modeled light intensity correlated to a mapped unique surface element of the digital object, wherein the light intensity matrix is a blurred matrix; and

a processor operatively coupled to the memory, whereby the processor determines pixel intensity values for rendering the digital object using matrix entries from the blurred matrix combined with a color map representing specular surface reflection from a modeled color non-neutral surface of the digital object, to provide a rendered appearance of the digital object emulating subsurface scattering in a translucent skin material.

Claim 16 defines all of the essential elements discussed in connection with claim 1, albeit in system form. Claim 16 is therefore allowable for the same reasons as Claim 1.

Similarly, with respect to claim 21, these references fail to disclose:

generating a first matrix of light intensity values representing diffuse reflection from a color-neutral surface excluding representation of subsurface light scattering and specular reflection; blurring the matrix of light intensity values;

generating pixel values of an image of the object using the blurred matrix of light intensity values in combination with a color map representing specular surface colors of the object to provide a rendered image simulating subsurface scattering in a skin surface of the object

Although claim 21 is more concise and differs in a few details from claim 21, it also includes essentially similar elements as claim 1. Claim 21 is therefore also allowable, for reasons similar to those explained above for claim 1.

Likewise, claim 23 is similar to claims 1, 16, and 21, and is allowable for the same reasons.

The remaining claims are likewise allowable, at least as depending from one of the allowable base claims 1, 16, 21 or 23.

The arguments presented in this response are sufficient to fully traverse the rejections under § 103. Therefore, applicants have not presented all possible arguments, and may not have refuted all characterizations of either the claims or the prior art as may be found in the Office Action. However, the lack of such arguments or refutations is not intended to waive such arguments or indicate concurrence with such characterizations.

Objection to Dependent Claims 13-15

Inasmuch as claims 13-15 all depend from at least independent claim 1, and as independent claim 1 is allowable as explained above over the references cited by the Office Action, it is respectfully submitted that claims 13-15 also are allowable over the references cited by the Office Action for the reasons provided above with respect to independent claim 1.

Objective Evidence of Non-Obviousness

The previously submitted evidence of non-obviousness demonstrates that the method as claimed by the independent claims is used extensively in real-world applications and that it is considered a novel and useful method for digitally rendering skin and other like materials by the computer graphics community. The present amendments merely clarify the scope of the claims to expressly include details that were previously implied. These amendments clarify the claims, but do not change the scope relative to what was presented in applicants' last response. The previously submitted declaration and exhibits therefore remain relevant as further evidence of non-

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May 16, 2008

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obviousness, demonstrating the recognition of experts in a highly technical field that the claimed methods and systems are novel, remarkably effective, noteworthy, and not obvious.

Conclusion

In view of the foregoing, the Applicant respectfully submits that claims 1-25 are in condition for allowance. Reconsideration and withdrawal of the rejections is respectfully requested.

To the extent it would be helpful to placing this application in condition for allowance, the Applicants encourage the Examiner to contact the undersigned counsel and conduct a telephonic interview.

While no fees are believed due in connection with the filing of this paper, the Commissioner is authorized to charge any fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-3683.

Respectfully submitted,

Date: May 16, 2008

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